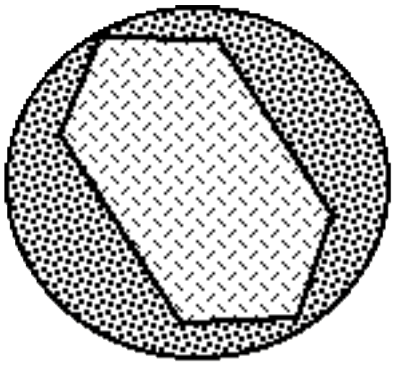

On Track

The Newsletter of the International Fission-Track Community
January 1999, Volume 8, Number 2, Issue 17

Editor: *Alexander Grist*
Fission Track Research Laboratory,
Department of Earth Sciences,
Dalhousie University, Halifax, Nova Scotia, Canada B3H 3J5
(agrist@is.dal.ca)

In this Issue:

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One copy per lab; please copy and distribute

On Track is a biannual newsletter of the international fission-track community. It is (usually) printed in the months of May and November. The views expressed in On Track are those of the authors and do not necessarily reflect those of the fission-track community or the editor(s) of On Track.

On Track will remain free, at least for the near future. However, to save costs we generally mail only one copy per lab so please be sure to pass On Track around your lab.

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CURRENT EDITOR:
Alexander Grist
Department of Earth Sciences
Dalhousie Universtiy
Halifax, Nova Scotia
Canada B3H 3J5
Tel. (902) 494-2372
Fax. (902) 494-6889
E-mail: agrist@is.dal.ca

Editor's Notes

I would first like to extend my thanks to the previous editor of On Track, **Paul O'Sullivan**. Without his help, as well as that from another previous editor **Trevor Dumitru**, the transition in editorship over the last few months would have been much more difficult than it was. On Track is beginning its ninth year of publication, and has evolved and grown significantly during those years, reflecting the ongoing need and importance of such a newsletter designed for fission trackers!

In this issue of On Track: **Diane Seward** and **Richard Spikings** write to tell about old and new mountains, labs, on other interests of the Swiss FT group at ETH in Zurich. There is a special announcement (and a mini poster insert) provided by **Barry Kohn** on the **FT Y2K** conference at Lorne, Victoria, Australia (having spent too many Februarys in the snow in Halifax, I am now making my travel plans). **Lisel Currie** (who is soon to be a mom!) also has an announcement for us (but its not about that, its about a special FT session, to be held during the GEOCANADA 2000 meeting in Calgary, Alberta, Canada). **Jari Filip** writes to tell the fission track community that he (and others) will establish a new fission track lab at the Institute of Geology of the Academy of Sciences of the Czech Republic. (I do so enjoy getting mail!). **Osamu Himeno** does a literature search for us. Some guy named **Sandy Grist** tells us what to do to get more gristy sand, and of course the short track news.

I would also like to thank **Trevor Dumitru** of FT Stage Systems, **Becky Jamieson**, of Dalhousie University, and **Mike Krochmal** of Autoscan Systems, who by ordering advertisements have permitted the continued free distribution of On Track. Most importantly, I would like to thank the man who pays my salary, **Marcos Zentilli**, who by allowing me to work on this issue for many days now, has also heavily subsidized its production costs.

Short Tracks: News

The following news items appeared magically in my e-mailboxinthelastfewmonths. First, **Paul Fitzgerald** wrote to say that after spending all of 1997 and some of 1998 in New Zealand working for Antarctica New Zealand as their first Science Strategy Manager, (sort of like a program manager, but for all the New Zealand science being done in Antarctica) as well as writing a new Antarctic science strategy for New Zealand, he is back at the University of Arizona working as a research scientist. He enjoyed his time as a young bureaucrat, but also enjoys being a scientist again - although he does miss the expense account. The highlight of his time there was a winter trip to Antarctica. He has fission track-based projects underway in Antarctica and the Pyrenees. He is currently on his next fieldseason in Antarctica (Dec. 98- Jan. 99) and upon his return can be reached at his new address: Paul Fitzgerald, Ph.D.,

Department of Geosciences, University of Arizona, PO Box 210077, Tucson, Arizona 85721, U.S.A . phone: (520) 621-4052.

Paul also tells us that **Scott Miller** finished his Masters thesis, entitled-
"Landscape development of the transantarctic Mountains, Shackleton Glacier area, Antarctica: An integration of structural geology, geomorphology, and apatite fission-track thermochronology" at the beginning of this year.

Maurice Pagel wrote to tell me that **Jean-Jacques Braun** is now working at ORSTROM in Yaoande, and is no longer interested in FT studies.

Barry Kohn informs us that with the appointment of **Andy Gleadow** as Professor and Head of Department of the School of Earth Sciences at the University of Melbourne in February 1999, the La Trobe fission track group, probably more accurately now called the Thermochronology Group, will be re-established there during the first half of 1999. The group looks forward to a new period of exciting research developments and practical applications. Note that the 9th International Conference on Fission Track Dating and Thermochronology will be hosted by the group out of the University of Melbourne (sited about 25 minutes drive from La Trobe) and all web and e-mail correspondence will be directed to addresses which will be based there (Ed: see ad this issue).

Special Announcement: GEOCANADA 2000

by Lisel Currie
Institute of Sedimentary and Petroleum Geology
3303-33rd St., NW, Calgary, Alberta, T2L 2A7, *Canada*
lcurrie@gsc.NRCan.gc.ca

A special session on fission track studies in Canada will be held at GEOCANADA 2000, a joint meeting of Canada's major geoscience societies, including the Geological Association of Canada, the Mineralogical Association of Canada, the Canadian Society of Petroleum Geologists, the Canadian Society of Exploration Geophysicists, and many more. The meeting will be held at the University of Calgary, Alberta, from May 29 to June 2, 2000. We feel that this special session will raise awareness of ongoing fission track studies, and the potential for future fission track studies in Canada. (Note: Previously discussed plans for a Fission Tracks in Canada workshop, and a low temperature thermochronometry short course have been put on hold).

The special session should be of interest to many people working in the oil and gas industry, as well as most ONTRACK readers. However, we expect that this session will be significantly different from, and will not detract from, the International Fission Track Workshop to be held in Australia during the same year. Most presentations are expected to focus on fission track studies of parts of Canada. Keynote talks will address the application of AFT to hydrocarbon exploration and the analysis of tectonics and environments in a variety of geological settings. In addition we hope that the AFT community shall contribute additional presentations and posters regarding their current work in thermochronology.

It is hoped that papers presented during the special session will contribute to a special volume of the Canadian Journal of Earth Sciences that will highlight Canadian fission track data and its application to geologic problems. The special session will be sponsored by the Structural Geology and Tectonics Division of the Geological Association of Canada.

Fission Track 2000

The 9th International Conference on Fission Track Dating and Thermochronology will take place at Lorne, Victoria, Australia on 6-11 February, 2000. The meeting will be held at the Cumberland Lorne Conference and Leisure Resort, which offers state-of-the-art conference facilities and technology.

Lorne, located some 140 km southwest of Melbourne in the heart of the Otway Basin, is one of Australia's most picturesque coastal towns. Golden sands and rolling surf on one side, the exotic rainforests and waterfalls of the Otway Ranges on the other – and the magnificent Great Ocean Road hugging the coastline in between makes this a superb destination.

The Conference will cover all important aspects of fission track analysis and its modern applications in earth and related sciences. It will be structured to identify new directions of research. The program will run as a single session and include: thematic sessions, two workshops, poster sessions and a mid-conference field trip in the Otway Basin. Two field trips, one pre- and one post-conference each of 4-5 days duration, may be offered depending on the initial response received.

Contributions can be submitted either as oral or poster presentations, but software presentations are also acceptable. Oral presentations will be selected by the Organizing Committee on the criteria of originality and relevance of a submitted abstract to the subject matter of a particular theme or workshop. English will be the official language of the Conference, both for oral and poster presentations.

A **comprehensive** web site has been established at:

http://ft2000.unimelb.edu.au

Please consult this site for further details

I've lost my apatite

by Sandy Grist
Fission Track Research Lab., Department of Earth Sciences
Dalhousie University, Halifax, Nova Scotia, Canada B3H 3J5
(agrist@is.dal.ca)

(or There's many a slip betwixt a cup and a lip!)

A fairly common problem encountered in the production of really good thermal history models and animations of evolving landscapes is that of a good sample gone bad. It started out with so much promise, a half split of a 150 mm diameter dirty sandstone drillcore that weighed about 2 kg with visible lamellae of (supposed) heavy minerals. You bash it through your standard procedure for procurement of apatite (jaw crusher, disk mill, tetrabromoethane (TBE) or sodium polytungstate (SPT), magnetic (Frantz), and di-iodomethane (MI) (even with constriction tubes), and then you look at it under the binocular microscope and..

Nothing (well almost nothing, few enough grains that you wonder if they are contaminants from the previous sample), and you ask yourself "What happened to the apatite?" So you painstakingly hand pick all fourteen euhedral grains and mount them in a nice line, polish and etch them (four had dislocations, four were zoned and the other six have only 10 tracks between them) (Oh yeah, this drillcore is from 4 km deep!). You get a couple of lengths from the zoned grains, and there's your thermal history data. I hope this doesn't sound too familiar!

So what went wrong? There are only two possibilities. Either there were only fourteen grains in the sample to begin with (This is the explanation most people tend to go with.) or somehow the apatite ended up somewhere other than on the grain mount. Its this latter possibility that I'd like to examine for a few paragraphs, and offer some tips that may help to increase the likelihood of getting a decent yield and more data out of that chunk of core. So lets look at what's being done during each step of the process.

Crushing and sieving: I would suggest that you set your disk mill plates to a spacing of about 0.1 mm and don't move them at all. Also, you don't have to put the rock through the mill more than twice. The coarse residue after the second pass is dominated by quartz shards, micas, and flat cherty and shaly bits that tend to heat up and wear out the plates rather than crush further. All the apatite is liberated by this time. I might also suggest that you try out a set of ceramic plates. These are very pricey, but...(allow me to sell you a couple).

-They are harder than the tungsten/carbide steel plates. The ceramic plates we currently have on our disk mill have seen more than 100 samples of many different rock types and they show no signs of wearing out any time soon, which makes them economical. Also, the metal grinding plate flakes that get produced (which ordinarily end up in your sample, rust badly upon washing, turn your tungstate blue, and coat and contaminate your apatite grains) don't!

-Ceramic is an insulator. They don't get hot, which is very important for your peace of mind and also reduces problems that you might otherwise encounter if your disk mill has a thermal shut-off.

Don't use a fine sieve to remove the fine-grained fraction (unless you are trying to get rid of drilling mud from cuttings). Apatite and the other heavy minerals tend to be more fine-grained than accompanying quartz and feldspars, especially in sedimentary rocks, and by tossing the fines you may be rejecting the most apatite-rich fraction. Use repeating washing to get rid of the fraction that is too small to work with (i.e. the clays and the powder that is produced by crushing). The fine-grained heavy minerals settle out more rapidly than light or flat grains and so are not lost. (a lab trick: If the samples smells strongly of oil and steadfastly refuses to wet, soak it in a solvent first (such as chloroform) to liberate the oil from grains or you will end up pouring a lot of grains down the sink.) The washing procedure is the same as you use to clean a sample after sieving to remove the fines, you just do it more times, so that the time you save sieving, you spend in extra washing.

Use a rectangular plastic flat-bottomed container. Agitate the sample with jets of water to a depth of about 20 cm. Wait about 20 seconds for everything coarse silt-sized and larger to settle out, and decant (pour off the muddy water without disturbing the sediment). For sandstones you have to do this about 20 times before the water becomes clear enough to easily see the sediment after the 20 seconds have elapsed. I know it seems like a lot of work, but at least the water isn't toxic, and its necessary if you want your TBE or SPT filtering to work correctly (or at all!).

TBE or SPT: This is fairly straightforward and Dave Coyle has already explained the mysteries of SPT (see OnTrack vol. 1 no. 3) so I won't. The key to success with these heavy liquids seems to be adequate stirring (see below). (As an aside, SPT forms a salt solution that is acidic, with a pH of about 2.7 when the density is about 2.8 g/cm^3. It does not dissolve apatite, but it is hard on the hands if you don't wear gloves.)

Look in the last magnetic fraction. Some apatite often ends up in the second-least magnetic

fraction. Perhaps because it contains some inclusions or coatings that make it slightly more magnetic, or perhaps the apatite has a range of magnetic susceptibilities that depend on its composition, or it could be just that the Frantz is not 100% effective, but there are often a few grains, and sometimes many-many grains in this fraction. It is definitely worth checking.

Hand-picking definitely biases samples. It is also excruciatingly slow and should be avoided as much as possible. When you select your apatite a grain at a time there is a tendency to pick the most euhedral, clean-looking grains. It is entirely possible that those milky-looking rounded grains that make up most of the separate that you are picking are also apatite, and are quite dateable.

A test for apatite (another lab trick): If you aren't sure if a mineral in the separate is apatite or not, here is one way to find out. Pick a couple of grains with a moistened 000 camel's hair brush (or with a needle mounted on the end of a disposable chopstick moistened with oil from behind your ear, or whatever technique you prefer to use to pick fly dung out of pepper). Place them in a few drops of dilute nitric acid. If they are apatite they will dissolve in a few minutes without producing any gas bubbles. Of course this is a destructive test, so don't use it if there are only a few of the grains present.

Mount some and find out for sure. The simple act of pouring an aliquot from a large-ish bottle of sample biases it (You tend to get large round grains coming out first.), so make sure that the grains you mount are the ones that you want to check on. One way to do this is to use what I call a paper slide (another lab trick). Simply spread the sample in a line across about a half-sheet of US letter or A4 paper and hold the end of the paper with the sample on it up about 5 cm (2 inches) and tap the edge lightly with a finger. The first grains down the hill are the large round ones, which could be some rounded detrital apatite from a blocky carbonate-rich separate, (this would be your sample) or it could be some of those annoying quartz-sulphide multiples (which would improve the purity of the remaining sample).

Next down the hill is the great majority of the grains (they tend to move together). The last grains down the hill, and those that refuse to slide tend to be the finest and the flattest. The finest may include some apatite. The flattest tend to be muscovite and/or quartz shards (These should have been removed by heavy liquids, but you often get a few hangers-on, probably from the sides of the funnel as a result of inadequate stirring.) which can easily be removed by sieving. You can do the paper slide several times and then mount the most likely looking fraction. I use the Naeser method using teflon-coated bakeware (yet another lab trick, and yet another culinary reference!) because it's cheap, very flat and doesn't stick to the epoxy. The mount is also so smooth that you don't even have to polish it to determine petrographically whether or not it contains apatite.

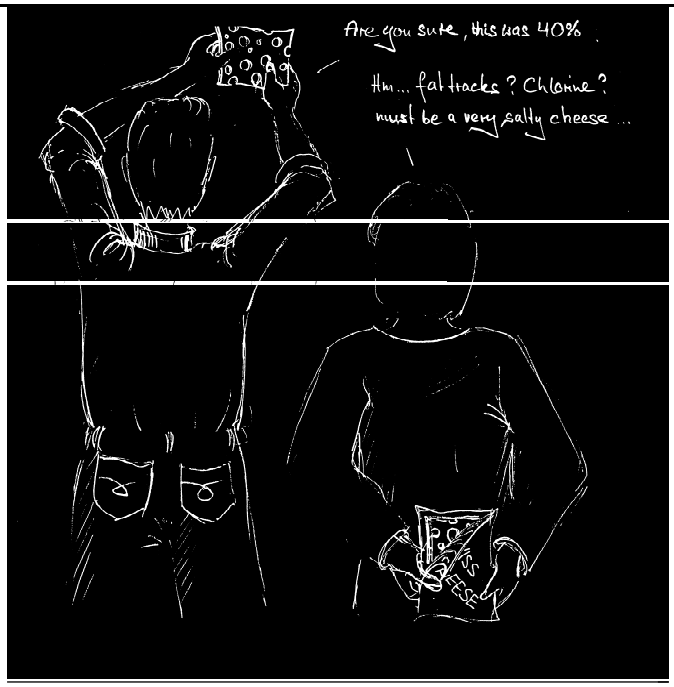
You may wonder "Of what use are the most fine-grained apatite if they are too small to date?" (because for geometry reasons you can't put your grid too close to an exterior surface). This limitation doesn't apply to length measurements. You can measure the length of a confined track anywhere on a grain. The fine-grained apatite is very useful for making extra length mounts or mounts for Cf252 irradiation to increase the amount of length data you obtain. Of course it's best to obtain your age and length data from the same grains, and in certain samples (like a 4 km deep drillcore) you risk biasing your length data towards more resistant Cl-rich grains relative to your age data by doing otherwise. However, with the exception of apatite from some granites it is often not possible to do this. The increasingly routine use of Ray Donelick's technique of irradiation of length mounts with Cf252 to increase available length data is evidence of this. (A.C. calls this Californicating.)

Of course some samples are just duds, and no amount of scratching around for more grains is going to help. But drilling for that core cost about a thousand dollars a meter, so you are going to want to squeeze out every grain. I hope that this will help you to get a few more.

(Ed. Note: See what happens when you don't submit articles!)

Swiss Tracks

by Diane Seward and Richard Spikings
CH-8092, Zurich, *Switzerland*
(diane@eurasia.ethz.ch / georas@luff.latrobe.edu.au)



Switzerland made its first siting of fission tracks in the 1980's when Tony Hurford built up a considerable fission-track group in Bern. When he left, there was a small hiatus until the present Swiss fission-track group began when **Diane Seward** arrived at ETH; it has grown steadily since 1990. We are a mixed group, not two from one nation. We are Spanish, Italian, French, English, New Zealand, Chinese, Austrian, Bulgarian and a single Swiss (who is working over the border in Germany!). Richard Spikings and Diane are lucky that our communication language is English for all. During its life span, research interests have concentrated on the application of the FT technique to various geological problems and most work is a combination of tracks with another discipline. Projects have included: sedimentary and dynamic basin evolution studies in the interAndean valley of Southern Ecuador; a post-orogenic regional study of the Uralian Orogenic Belt; retracing the Gondwanan history of Madagascar; and an ever-expanding number of projects related to the development of the European alpine chain, the Himalayas and related basin systems. The purpose of this contribution is to present the currently active projects and a small amount of recently acquired data.

Europe

The European Alpine Project recently started with **Meinert Rahn** (our singing scientist) and **Diane Seward** in charge. The final goal of this project is to generate, with the aid of AFT analysis, a contoured exhumation history of a very young orogeny possessing a considerable amount of topographic relief. Basically, this means digging into the literature, compiling all existing data (and there is a lot!) and generating more, particularly track length measurements which are missing in most old studies. Data compilation and computer modelling shall be performed and will be presented at the Melbourne Work Shop. Because we have to restrict ourselves to an area that can be handled in a reasonable amount of time, (2 years), we will focus on the Central Alps, between Mont Blanc in the West and the Brenner line in the East. Additionally, the project will profit highly from several other contemporaneous multidisciplinary studies in the Central Alps.

Diane also has a project in the region of Pelvoux, southeast France together with a colleague currently in Nancy, France, as well as one in the southern Alps - not the New Zealand ones!

Bernhard Fugenschuh, who completed a Ph.D. at ETH in 1994 has established a FT lab' in Basel (all of one hour away by train). He is concentrating his efforts in the western Alps and the Carpathians. Most of his FT work is combined with structural geology and detailed field mapping. For those of you not working in young terranes it is amazing (encouraging ??) to see how much fine detail Bernhard is being able to extract from his data set.

Giulio Viola has been a Ph.D. student at ETH for more than two years. He is concentrating his study in the gastronomic region of northern Italy where he is attempting to quantify fault displacements along the Periadriatic fault system. Additionally, he is also performing extensive structural field studies and laboratory analyses in order to investigate the processes of mylonite formation.

Lourdes Sanchez Rodriguez has confirmed, via the use of FT analysis in conjunction with a SHRIMP study on zircons, the extremely rapid exhumation of the Ronda in southern Spain. Lourdes has almost completed her Ph.D thesis and is taking a position with Shell Research in the Hague in December.

Alexandre Kounov, our Bulgarian geologist, is currently busy attacking geological questions of the Balkan Peninsula (without the aid of UN resolutions and a shiny kalashnikov). Alex is combining AFT/ZFT analysis with sedimentary basin and mapping studies in order to analyse the thermal and tectonic evolution of the Osogovo-Lisec core complex in Western Bulgaria.

Ecuador

After departing the 16th Latin American Kongress (October 1998), which was hosted in northern Bavaria (hic!), it was clear that with the exception of two folks, one from the UK and one from France, Ecuador has suffered years of neglect from geologists - they're all further south in Argentina and Chile. However, Ecuador presents an interesting set of geological problems and ETH has been contributing to the study of Ecuadorian geology since 1993.

The Ecuadorian continental margin has been active for ~230 Ma, starting within the Tethyan spreading system and currently overriding the Nazca Plate. Traversing cratonwards, this period of almost continual tectonism has resulted in the superposition of an Eocene forearc sequence, late Miocene western Sierra, early Miocene interandean basins, a late Cretaceous eastern Sierra and a foreland basin which is commonly thought to have been developing since the Maastrichtian. These geologically defined regions rest unconformably on a late Triassic distensive continental margin which is in-filled with Jurassic carbonate and volcanic sequences.

The first contributions came from **Dominik Hungerbuhler** and **Michi Steinmann** (1 Diplom and Ph.D each) who combined zircon and apatite FT analysis with sedimentological studies within basins of the interandean valley. (Dominik has now moved to Shell Research and Michi is in Peru working for Glencore, so jobs do exist after fission track!) This approach resulted in tightly constraining the timing of intermontane and marine stages and hence the development of the Western Sierra as a prominant topographic ridge.

Our current interests are concentrated further eastwards (a weak attempt to avoid the aspirin starved Pichincha volcano) where we are studying the relationship between the development of the eastern Sierra and the foreland basin. The study includes a structural, $^{40}Ar/^{39}Ar$ and AFT/ZFT investigation of various regions of the eastern Sierra (**Richard Spikings**) and combined sedimentological and AFT/ZFT work in the foreland basin (**Geoffrey Ruiz**). Our initial objective is to test the geodynamic foreland basin model of DeCelles and Giles (1996). Quantification of the rates of structural development and foreland migration of the Sierra and its orogenic wedge system will be combined with a knowledge of chrono-stratigraphy, sedimentation rates, sedimentary provenance and the timing of development of angular unconformities within the foreland basin. It is early days, but initial AFT ages from the Sierra vary between ~ 80 - 20 Ma, and show considerable variation of ~ 50 Ma over N-S trending mapped faults. Apatite uranium levels tend to be low (< 5 ppm) so unfortunately confined horizontal tracks are scarce, however, initial track-length distributions are narrow with long mean lengths (> 13.6 □m). Sedimentological observations from the orogenic wedge suggest the foreland basin may have been initiated as early as the Aptian.

It's always comforting to return back to friendly Switzerland, the therapeutic chirp of the cuckoos, clean pavements with evenly spaced cracks, and most of all, commanding officer Seward not yelling "is that tree trunk an anaconda or a tree trunk?"

The outside world

Prof. **Zuyi Zhao** visited ETH for one year during 1997 - 1998. After wrestling with the fission-track technique he is eager to establish a similar laboratory in Shanghai, China. Zuyi completed several sets of drill hole data from the Jiangsu Basin, north of Shangai and taught us all the rudiments of Chinese music while he was in the laboratory counting.

Diane continues to work in the Urals and Madagascar. These two projects are approaching completion and both seem to have some interesting information with respect to chemistry and long term annealing. The Urals are so boring... the same ages from north to south and east to west.... maybe we have reached the limits of interpretation that fission-track analysis can achieve when assessing post-orogenic histories of old orogenic belts. Samples from Mongolia also present the same problem.

Matevz Lorencak has completed a diplom (MSc equivalent) analysing the Shushwap core complex, in Canada. He plans to continue his academic career and proceed with postgraduate studies involving fission-track analysis.

Marc Jolivet appears as often as he can. He escapes the ambience of southern France for a dose of sobriety (!) in the lab here. Marc is working in the Northern belts of Tibet, specifically the Altyn Tagh and Qilian Shan. Apatite ages there range from 6 to 20 Ma, in good agreement with previous work by Tapponnier et al, (1998) based on tectonic and sedimentary studies. So far Zircon FT ages are all Jurassic, though this may change as his sample number increases. He is learning the methods here while completing ages for his Ph.D thesis. A brand new Zeiss microscope arrived a few weeks ago in Montpellier and it is hoped that a fission-track facility will be developed there.

Aufwiedersehen...(pet)

A letter to the editor:

Prague, 1 December, 1998

Dear Mr Grist,

I would like to inform you that a fission-track laboratory will be established at the Institute of Geology of the Academy of Sciences of the Czech Republic. Last year we decided to develop the laboratory for all our colleagues — geologists in the Czech Republic — to use the advantages of this method for propagating their scientific studies. This method has not systematically been developed and used in our country, and we hope for a good acceptance with the Czech community of geologists.

But the start is not so easy as it seemed to be at first. Fortunately, we have met many good people who helped us willingly.

I am very obliged to Dr. Ulrich Mann (Institut fuer Chemie und Dynamik der Geosphaere - Forschungszentrum Juelich) who involved me in his research project, and to the Deutsche Forschungsgemeinschaft (DFG) for its financial support without which it I would not have been able to realize my foreign stay; during this stay I had the exceptional chance to work at the Forschungsstelle Archaeometrie of the Max-Planck-Institut fuer Kernphysik at Heidelberg.

I am most grateful to Professor Wagner who received me friendly at his laboratory and made it possible for me to work there, and to Dr. Glasmacher and Dr. Jonkheere who helped me with my first diffident steps in the F-T analysis field.

I am greatly indebted to Professor Hurford (Research School of Geological Sciences, London) and Dr Kohn (Department of Earth Sciences, La Trobe University) who sent personally CN5 glasses and apatite standards to Heidelberg during my stay there and expressed interest in my efforts.

Dear Mr Grist, please would you be so kind as to inform the whole international F-T community about establishing the F-T laboratory at our Institute, and include my name and address in the International Fission-Track Directory.

I hope all the "Trackers" will accept a new member of their community with kind favour, and I look forward to meeting them at the 2000 Fission Track Conference.

Yours sincerely,
Jiri Filip

Filip, Jiri
Institute of Geology
Academy of Sciences of the Czech Republic
Rozvojova 135
165 02 Prague, Czech Republic

Tel.: +420-2-20922628, ext. 248
Fax: +420-2-20922670
E: filip@gli.cas.cz

Recent Fission-Track Papers

Here is a list of recently or soon-to-be published fission track papers that were submitted by the authors for inclusion in this issue of On Track. I am grateful to the authors for the information. If you have a paper that you would like to see listed in this section, please send the complete reference or a photocopy of the first page to the editor. A copy of the entire paper would also be appreciated. We are also interested in non-fission-track papers that may be of special interest to the fission-track community. Papers in press are welcome, please include an estimate of the expected month of publication.

Fitzgerald P.G. and S.L. Baldwin, 1997. Detachment Fault Model for the Evolution of the Ross Embayment. In: Ricci C.A. (ed.), The Antarctic Region: Geological Evolution and Processes, Terra Antarctica Publication,
Siena, 555-564.

Fitzgerald, P. G., and Stump, E., 1997, Cretaceous and Cenozoic episodic denudation of the Transantarctic Mountains, Antarctica: New Constraints from apatite fission track thermochronology in the Scott Glacier region, Journal of Geophysical Research, **102**, 7747-7765.

Yegingil Y., Bigazzi G., Poupeau G. and Bellot-Gurlet L. (1998) Provenance studies of obsidian artefacts in Anatolia : the contribution of the fission track analyses, in : Light on Top of the Black Hill, Eds. G. Arsebuk, M. J. Mellink et W. Schirmer, EGE Publications, Istanbul, 823-844.

Bellot-Gurlet L., Calligaro Th., Dorighel O., Dran J.-C., Poupeau G. and Salomon J. (1998) PIXE analysis and fission track dating of obsidian from South American prehispanic cultures : an insight over the circulation of a lithic industry raw material, Nuclear Instruments and Methods B, in press.

Poupeau G., Saddiqi O., Michard A., Oberh‰nsli R. and GoffÈ B. (1998) Late thermal evolution of the Oman Mountains sub-ophiolitic windows : apatite fission track thermochronology, Geology, in press.

ED. NOTE: Submissions for this section were a bit thin, so Osamu Himeno graciously volunteered to compile a list of recent (Jan. to Oct. 1998) fission track papers for inclusion in this issue.

A list of recent fission track papers:

A list of papers published from January to October, 1998, located by a Georef search using the key-word 'fission track'

Compiled by: Osamu Himeno,
Dept. of Mining Eng., Kyushu University, Fukuoka, Japan,
(himeno@mine.kyushu-u.ac.jp)
Current Address: Fission Track Research Lab., Department of Earth Sciences
Dalhousie University, Halifax, Nova Scotia, Canada B3H 3J5
(ohimeno@is2.dal.ca)

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Call for Contributions to the May/June 1999 On Track issue 18

The next issue of On Track is scheduled for release in late May/June, 1999 and we are looking for contributions. On Track welcomes contributions of virtually any kind, including news, gossip, job openings, descriptions of new lab techniques, reviews of useful products, raving editorials about what all the other labs are doing wrong, meeting announcements, cartoons, and descriptions of what you are doing in your research.

If you would like to contribute, **PLEASE** send the final text no later than May 15, 1999. If you propose to submit a substantial article, **PLEASE** let the editor know ASAP.

On Track includes a list of recent and forthcoming Fission Track papers. If you know of a paper that was published recently or is in press and should appear in the near future, please let me know so that it can be added to the list. Also, if you happen to move locations (or know someone who has moved) due to a change in jobs or finishing off the thesis and graduating, please inform us.

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Alexander (Sandy) Grist, Fission Track Research Laboratory,
Department of Earth Sciences, Dalhousie University, Halifax, Nova Scotia, Canada B3H 3J5
Phone: (902) 494-2372; Fax: (902) 494-6889; E-mail: (agrist@is.dal.ca)

1998 UPDATE OF THE INTERNATIONAL FISSION-TRACK DIRECTORY

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Aizawa, Minoru
Dept. of Geology
Imperial College
Prince Consort Road
London SW7 2BP, *UK*
Tel.: +44 (0) 171-594-6468
Fax: +44 (0) 171-594-6464
E: m.aizawa@ic.ac.uk

Andriessen, Paul A.M.
Laboratorium voor Isotopen Geologie
Faculteit der Aardwetenschappen
Vrije Universiteit de Boelelaan 1085
1081 HV Amsterdam, *The Netherlands.*

Arne, Dennis C.
Dept. of Geology
Univ. of Ballarat, P.O. Box 663
Ballarat, VIC 3352, *Australia*
Tel.: 61-53-279-290,
Fax: 61-53-279-144
E: D.Arne@ballarat.edu.au

Bal, K. D.
Fission Track Laboratory
KDM Institute of Petrol. Exploration
Oil and Natural Gas Corporation
Dehradun, *India.*

Baldwin, Suzanne
Dept. of Geosciences
Univ. of Arizona
Tucson, AZ 85721, *USA*

Balestrieri, Maria Laura
Dipartimento di Scienze della Terra
via S. Maria, 53
56126 Pisa, *Italy*

Barbero, Luis
Dpto Geologia
Facultad de Ciencias del Mar
Universidad de Cadiz
1150 Puerto Real, Cadiz
Spain
Tel.: int-34-956-470824
Fax: int-34-956-470864

Belton, Dave X.
Department of Earth Sciences
La Trobe University
Bundoora, VIC 3083, *Australia*
Tel.: 61-3-479-2630
Fax: 61-3-479-1272
E: geodxb@luff.latrobe.edu.au

Bergman, Steven C.
ARCO Exploration & Production
2300 W. Plano Parkway
Plano, TX 75075-8499, *USA*
Tel.: 1-214-754-6264
Fax: 1-214-754-6807
E: BERGMAN@mail.arco.com

Bigazzi, Giulio
Instituto di Geochronologia e Geochimica Isotopica,
CNR, via Cardinale Maffi, 36
56127 Pisa, *Italy*
Tel.: +39-50-560430/560110
Fax: +39-50-589008

Blythe, Ann E.
Dept. of Earth Sciences
Univ. of Southern California
Los Angeles, CA 93106, *USA*
E: blythe@earth.usc.edu

Boettcher, Stefan S.
Dept. of Geological Sciences
Univ. of Texas at Austin
Austin, TX 78712, *USA*
Tel.: 1-512-471-8547
Fax: 1-512-471-9425
E: sboett@maestro.geo.utexas.edu

Bojar, Ana-Voica
Insitute für Geologie and Paläontologie
Karl-Franzens Universität
Heinrichstraße 26
A-8010 Graz, *Austria*
Fax: 43-316-382885

Brandon, Mark T.
Dept. of Geology and Geophysics,
Kline Geology Laboratory
P.O. Box 6666
Yale Univ.
New Haven, CT 06511, *USA*

Brix, Manfred R.
Ruhr-Universität Bochmum,
Fakultat fur, Geowissenschaften
Institu fur Geologie
Postfach 102148
Universitätsstraße 150
D-W 4630 Bochum 1, *Germany*
Tel.: +49-234-700-3236
Fax: +49-234-709-4179

Brown, Roderick W.
Department of Earth Sciences
La Trobe University
Bundoora, VIC 3083, *Australia*
Tel.: 61-3-479-1368
Fax: 61-3-479-1272
E: rod.brown@latrobe.edu.au

Brunel, Maurice
ISTEEM GGP laboratory CC 058
Universite Montpellier II
1 Place E. Bataillon
34095 Montpellier
Cedex,, *France*
E: brunel@dstu.univ-montp2.fr

Burchart, Jan
Institute of Geological Sciences
Polish Academy of Sciences
Zwirki i Wigury 93
02-089 Warsaw, *Poland*

Buck, Steve
Mobil North Sea Ltd.
Union Row
Aberdeen AB1 1SA, Scotland *UK*
E: spbuck@abz.mobil.com

Calmus, Thierry
Instituto de Geología
Estación Regional del Noroeste
Universidad Nacional Autonoma de México
Apartado Postal 1039
Hermosillo, Sonora, 8300, *Mexico*
E: tcalmus@servidor.unam.mx

Carlson, William D.
Dept. of Geological Sciences
Univ. of Texas at Austin
Austin, TX 78712, *USA*
Tel.: 1-512-471-4770
Fax: 1-512-471-9425
E: wcarlson@ccwf.cc.utexas.edu

Carpena, Joelle
DSD-SCS-LGCA
C.E.N. Cadarache
13108 Saint Paul lez Durance CDX,
France

Carpenter, Stephen B.
A505 Administration Bldg.
National Institute of Standards and Technology,
Gaithersburg, MD 20841, *USA*

Carter, Andrew
Fission Track Research Group
Dept. of Geological Sciences
Univ. College London
London WC1E 6BT, *UK*
Tel.: (0)171-380-7777 ext 2418
Fax: (0)171-813-2802
E: a.carter@ucl.ac.uk

Cederbom, Charlotte
Institution of Geology
Earth Sciences Centre
S-413 81 Gothenburg, *Sweden*
Tel.: +46 31 773 2800
Fax: +46 31 773 2849
E: cederbom@geo.gu.se

Chambaudet, Alain
Universite de Franche-Comte
U.F.R. des Sciences et des Techniques,
Laboratoire de Microanalyses Nucleaires,
16 route de Gray
F-25030 Besancon Cedex, *France*

Clavero, Jorge
Sernageomin
Av. Sta. Maria 0104
Casilla 10465
Providencia, Santiago de Chile
Tel: (56-2) 737-5050
Fax: (56-2) 777-1906
E: JClavero@SERNAGEOMIN.cl

Coleman, Max
Research Inst. for Sedimentology
The Univ. of Reading
PO Box 227, Whiteknights
Reading, RG6 6AB, *UK*

Cloos, Mark
Dept. of Geological Sciences
Univ. of Texas at Austin
Austin, TX 78712, *USA*
Tel.: 1-512-471-4170,
Fax: 1-512-471-9425
E: cloos@maestro.geo.utexas.edu

Corrigan, Jeff D.
ARCO Exploration & Production
2300 W. Plano Parkway
Plano, TX 75075, *USA*
Tel.: 1-214-509-4090
E: dprjdc@arco.com

Coyle, David A.
Tensor Information Systems, *USA*
Home: 1102 New Dover Rd.
Apex, NC, 27502-7129, *USA*
Tel.: 1-919-303-6607

E: dcoyle@tensor.com
or: dcoyle@objectfarm.org

Crowley, Kevin, D.
Director
Board on Radioactive
Waste Management,
National Research Council
2101 Constitution Ave., N.W.
Washington, D.C. 20418, *USA*
Tel.: 1-202-334-3066,
Fax: 1-202-334-3077
E: kcrowley@nas.edu

Currie, Lisel
Institute of Sedimentary and
Petroleum Geology
3303-33rd St., NW
Calgary, Alberta, T2L 2A7,
Canada
Tel.: 1-403-292-7004,
Fax: 1-403-292-4961
E: lcurrie@gsc.NRCan.gc.ca

Danahara, Tohro
Kyoto Fission-Track Co., Ltd.
44-4 Minamitajiri-cho, Kita-ku,
Kyoto 603, *Japan*
Tel.: +81-75-493-0684
Fax.: +81-75-493-0741
E: BYU02730@niftyserve.or.jp

De Corte, Frans
Institute for Nuclear Sciences
Univ. of Gent
Proeftuinstraat 86
B-9000 Gent, *Belgium*

Decker, John E.
ARCO International, Inc.
Jakarta, *Indonesia*
E: JDECKER1@mail.arco.com

De Wispelaere, Antoine
Institute for Nuclear Sciences
Univ. of Gent
Proeftuinstraat, 86
B-9000 Gent, *Belgium*
Tel.: +32-9-264-6627
Fax: +32-9-264-6699
E: antoine.dewispelaere@rug.ac.be

de Wit, M.C.J.
American Research Lab. (Pty) Ltd.
PO Box 106 Crown Mines 2025
Johannesburg, *South Africa*

Dodson, Martin H.
Dept. of Earth Sciences
Univ. of Leeds
Leeds, LS2 9JT, *UK*

Dokka, Roy K.
Dept. of Geology
Louisiana State Univ.
Baton Rouge, LA 70803, *USA*
Tel.: 1-504-388-2975

Donelick, Raymond A.
Donelick Analytical, Inc.
4819 Katy-Hockley Road
Katy, TX 77493-4826, *USA*
Tel.: 1-281-371-3346,
Fax: 1-281-371-0133
E: 72762.1465@compuserve.com

Dorighel, Olivier
Groupe de Geophysique Nucleaire
Univerite Joseph Fourier
Institut Dolomieu
15, Rue Maurice - Gignoux
38031 Grenoble Cedex, *France*

Duddy, Ian R.
Geotrack International Pty Ltd
37 Melville Road
West Brunswick
VIC 3055, *Australia*
Tel.: +61-3-9380-1077
Fax: +61-3-9380-1477
E: mail@geotrack.com.au

Dumitru, Trevor A.
Dept. of Geology,
Stanford Univ.
Stanford, CA 94305-2115, *USA*
Tel.: 1-415-725-1328,
Fax: 1-415-725-2199
E: trevor@pangea.stanford.edu

Duncan, Alasdair
BP Exploration
PG8G (2/4S W10)
301 St. Vincent Street
Glasgow, G2 5DD, Scotland, *UK*

Dunkl, Istvan
Hungarian Academy of Sciences
Lab. for Geochem. Research, H-
1112, Budapest, Budaorsi ut 45,
Hungary
Tel.: +36-1-185-1781,
Fax: +36-1-185-1781
E: h6580dun@ella.hu

Durrani, Saeed A.
School of Physics and Space
Research,
Univ. of Birmingham,
Birmingham B15 2TT, *UK*
Tel.: +44-21-414-4691/4655
Fax: +44-21-414-4693

Eby, G. Nelson
Dept. of Earth Sciences
Univ. of Massachusetts
Lowell, MA 01854, *USA*
Tel.: 1-508-934-3907
Fax: 1-508-934-3003
E: ebyn@woods.ulowell.edu

Evarts, Russ
U.S. Geological Survey, MS-999
345 Middlefield Road
Menlo Park, CA 94025, *USA*

Fayon, Annia K.
Dept. of Geology and Geophysics
108 Pillsbury Hall
310 Pillsbury Dr SE
Minneapolis, MN 55455, *USA*
Fax: 1-612-625-3819
E: fayon001@tc.umn.edu

Fisher, David E.
Dept. of Geological Sciences
Univ. of Miami
Miami, FL 33124-0401, *USA*
Tel.: 1-305-284-3254
Fax: 1-305-284-4258

Fitzgerald, Paul G.
Dept. of Geosciences
Univ. of Arizona,
Tucson, AZ 85721, *USA*
Tel.: 1-602-621-4052
Fax: 1-602-621-2672
E: kiwi@sapphire.geo.arizona.edu

Fleischer, Robert L.
Dept. of Geology
Union College
Schenectady, NY 12308, *USA*
Tel.: +1 (518) 388-6985
Fax.: +1 (518) 388-6789
E: fleischr@union.edu

Foland, Sara S.
Amoco Production Company
1670 Broadway
P.O. Box 800
Denver, CO 80201, *USA*

Foster, David A.
Department of Earth Sciences
La Trobe University
Bundoora, VIC 3083, *Australia*
Tel.: 61-3-479-1516
Fax: 61-3-479-1272
E: D.Foster@latrobe.edu.au

Fugenschuh, Bernhard
Geologisches Institut
Univ. of Basel, Basel, *Switzerland*

Galbraith, Rex F.
Dept. of Statistical Science
Univ. College, Gower Street
London, WC1E 6BT, *UK*
Tel.: +41-71-380-7192
Fax: +44-71-383-4703
E: rex@stats.ucl.ac.uk

Gallagher, Kerry.
Dept. of Geology
Imperial College,
London, SW7 2BT, *UK*
Tel: 0171-594-6424
Fax: 0171-594-6464
E: kerry@ic.ac.uk

Ganzawa, Yoshiro
Hokkaido Univ. of Education
1-2 Hachiman-cho
Hakodate, 040, *Japan*
Tel.: 81-0138-41-1121
Fax: 81-0138-42-3982

Garver, John I.
Dept. of Geology
Union College
Schenectady, NY 12308-2311,
USA
Tel.: 1-518-388-6517,
Fax: 1-518-388-6789
E: garverj@union.edu

George, Pete
Dept. of Geological Sciences
Univ. of Texas at Austin
Austin, TX 78712, *USA*

Gibson, Helen
Geotrack International Pty Ltd
37 Melville Road
West Brunswick
VIC 3055, *Australia*
Tel.: +61-3-9380-1077
Fax: +61-3-9380-1477
E: mail@geotrack.com.au

Giegengack, Robert
Geology Dept.
Univ. of Pennsylvania
Philadelphia, PA 19104-6316,
USA

Giger, Matthias
Dammweg 27
3604 Thun, *Switzerland*
Tel.: 0041-33-368-227

Giles, Melvin R.
EPT-HM
Volmerlaan 8
Risswijk, *The Netherlands*
E: gilesm@siep.shell.com

Glasmacher, Ulrich
Forschungsstell Archaometrie der
Heidelberger Akademie der
Wissenschaften
Max Planck Institut fur
Kernphysik
Postfach 103980
69029 Heidelberg, *Germany*
Tel.: +49 (6221) 516-321
Fax.: +49 (6221) 516-633
E: Glasmach@goanna.mpi-
hd.mpg.de

Gleadow, Andrew J. W.
Department of Earth Sciences
La Trobe University
Bundoora, VIC 3083, *Australia*
Tel.: 61-3-479-2649
Fax: 61-3-479-1272
E: A.Gleadow@latrobe.edu.au

Graefe, Kirsten
Institut fuer Geologie
Universitaet Tuebingen
Sigwartstrasse 10
D-72076 Tuebingen, *Germany*
E: graefe@uni-tuebingen.de

Green, Paul F.
Geotrack International Pty Ltd
37 Melville Road
West Brunswick
VIC 3055, *Australia*
Tel.: +61-3-9380-1077
Fax: +61-3-9380-1477
E: mail@geotrack.com.au

Grist, Alexander
Dept. of Earth Sciences
Dalhousie Univ.
Halifax, Nova Scotia, B3H 3J5, *Canada*
Tel.: 1-902-494-2372
Fax: 1-902-494-6889
E: agrist@is.dal.ca

Grivet, Manuel
Universite de Franche-Comte
U.F.R. des Sciences et des Techniques
Laboratoire de Microanalyses Nucleaires
16, route de Gray
F-25030 Besancon Cedex, *France*

Guglielmetti, Alessandra
Instituto di Fisica Generale Applicata
Via Celoria 15
20133 Milano, *Italy*
E: guglielmetti@mi.infn.it

Gunnell, Yanni
Laboratoire de Geographie Physique,
URA, 1562, CNRS,
Univesité Blaise-Pascal,
29 Bvd. Gergovia, 63037,
Clermont Ferrand, CEDEX 1, *France*

Hadler, Julio C.
Instituto de Fisica "Gleb Wataghin"
Universidade Estadual de Campinas
UNICAMP, Campinas, SP, *Brazil*
Caixa Postal 6165
CEP 13083-970
Tel.: 55-19-788-5522
Fax: 55-19-788-5512

Hansen, Kirsten
Geological Institute
Oster Volgrade 10, DK-1350
Kobenhavn K, *Denmark*
Tel.: (home) 45-31-42-18-94
Fax: 45-33-14-84-33
E: kirstenh@geo.geol.ku.dk

Harman, Rebecca
Department of Geology
Imperial College,
London, SW7 2BT.*UK*
Tel.: (0171) 589-5111 ext. 56411
E: r.harman@ic.ac.uk

Harrison, Mark T.
Dept. of Earth and Space Sciences
Univ. of California, Los Angeles
Los Angeles, CA 90024, *USA*

Hasebe, Noriko
Dept. of Science for Natural Environment
Division of Physical Sciences
Kanazawa University
Kanazawa 920-1192, *Japan*
Tel. 81-76-264-5727
Fax: 81-76-264-5746
E: hasebe@kenroku.ipc.kanazawa-u.ac.jp

Hashemi-Nezhad, S.R.
Dept. of Physics
Tabriz Univ.
Tabriz, *Iran*

Hayashi, Masao
Kyushu Sangyo Univ.
Fukuoka 813, *Japan*
Tel.: 092-673-5883,
Fax: 092-673-5899

Hegarty, Kerry A.
Geotrack International Pty Ltd
37 Melville Road
West Brunswick
VIC 3055, *Australia*
Tel.: +61-3-9380-1077
Fax: +61-3-9380-1477
E: mail@geotrack.com.au

Hejl, Ewald R.
Institut fur Geologie und Palaontologie
Universitat Salzburg,
Hellbrunnerstraße 34/III
A-5020 Salzburg, *Austria*
Tel.: + 43-662-8044-5437/5400
Fax: + 43-662-8044-621
E: ewald.hejl@sbg.ac.at

Hill, Kevin C.
Department of Earth Sciences
La Trobe University
Bundoora, VIC 3083, *Australia*
Tel.: 61-3-479-1273
Fax: 61-3-479-1272
E: K.Hill@latrobe.edu.au

Himeno, Osamu
Dept. of Mining Eng
Kyyushu Univerity
Hakozaki, Fukuuka 812-81, *Japan*
Tel.: 092-642-3635
E: himeno@mine.kyushu-u.ac.jp

Honda, Teruyyki
Atomic Energy Research Laboratory
Musashi Institute of Technology
Kawasaki 215, *Japan*

Hulver, Michael L.
Dept. of the Geophysical Sciences
Univ. of Chicago
5735 S. Ellis Avenue
Chicago, Illinois 60637, *USA*

Hungerbuhler, Dominik
Dept. Erdwissenschaften
ETH-Zentrum
CH-8092, Zurich, *Switzerland*

Hurford, Anthony J.
Research School of Geological Sciences
Univ. and Birbeck Colleges,
London WC1E 6BT, *UK*
Tel.: +41-71-380-7704
Fax: +44-71-388-7614
E: t.hurford@ucl.ac.uk

Iriarte, Sergio
Sernageomin
Av. Sta. Maria 0104
Casilla 10465
Providencia, Santiago de Chile
Tel: (56-2) 737-5050
Fax: (56-2) 777-1906
E: SIriarte@SERNAGEOMIN.cl

Issler, Dale R.
Geological Survey of Canada
Institute of Sedimentary and Petroleum Geology
3303-33rd St., NW
Calgary, Alberta, T2L 2A7, *Canada*
Tel.: 1-403-292-7172,
Fax: 1-403-292-5377
E: dissler@gsc.nrcan.gc.ca

Ito, Hisatoshi
Central Research Institute of Electric Power Industry (CRIEPI)
1646 Abiko, Abiko city,
Chiba, 270-1194, *Japan*
Tel.: 81-471-82-1181 ext 8525
Fax: 81-471-83-3182
E: ito_hisa@criepi.denken.or.jp

Iwano, Hideki
Kyoto Fission-Track Co., Ltd.
44-4 Minamitajiri-cho, Kita-ku,
Kyoto 603, *Japan*
Tel.: +81-75-493-0684
Fax.: +81-75-493-0741
E: BYU02730@niftyserve.or.jp

Jacobs, Joachim
Fachbereich 5, Geowissenschaften
Universitaet Bremen Postfach 330440
28334 Bremen, *Germany*
Tel: 0421-218-3995
Fax: 0421-218-3993
E: jojacobs@geopol.uni-bremen.de

Johnson, Kit
Fission Track Research Group
Dept. of Geological Sciences
Univ. College London
London WC1E 6BT, *UK*
Tel.: (0)171-380-7777 ext 2418
Fax: (0)171-813-2802
E: kit.johnson@ucl.ac.uk

Jolivet, Marc
ISTEEM GGP laboratory CC 058
Universite Montpellier II
1 Place E. Bataillon
34095 Montpellier Cedex,, *France*
E: jolivet@dstu.univ-montp2.fr

Jonkheere, Raymond
Particle-track-dating Laboratory,
Max Planck Institut fur Kernphysik
D-69117 Heidelberg, *Germany*
Tel.: +49 (6221) 516-337
Fax.: +49 (6221) 516-633
E: raymond@goanna.mpi-hd.mpg.de

Kamp, Peter J.
Dept. of Earth Sciences
Univ. of Waikato
Hamilton 2001, *New Zealand*
Tel.: 64-7-856-2889
Fax: 64-7-856-0115

Kelley, Shari A.
Department of Earth and Envir. Sciences
New Mexico Tech
Soccoro, NM 87544, *USA*
Tel.: (505) 661-6171
E: kelley@griffey.nmt.edu
sakelley@ix.netcom.com

Kendrick, Dan
Department of Earth Sciences
La Trobe University
Bundoora, VIC 3083, *Australia*
Tel.: 61-3-479-1273
Fax: 61-3-479-1272
E: geordk@luff.latrobe.edu.au

Ketcham, Richard
Dept. of Geological Sciences
Univ. of Texas at Austin
Austin, TX 78712, *USA*
Tel.: 1-512-471-5763,
Fax: 1-512-471-9425
E: richk@maestro.geo.utexas.edu

Kim, Joong Wook
Dept. of Science Education
Taegu Natl' Univ. of Education
Daemyung-2 Nam-gu, Taegu, 705-715, *Korea*
Tel.: 82-53-620-1343
Fax: 82-53-620-1340
E: jwkim@taekyo.taegu-e.ac.kr

Kohn, Barry P.
Department of Earth Sciences
La Trobe University
Bundoora, VIC 3083, *Australia*
Tel.: 61-3-479-1516/1274,
Fax: 61-3-479-1272
E: B.Kohn@latrobe.edu.au

Koshimizu, Satoshi
Yamanashi Institute of Environmental Sciences
Kamiyoshida, Fujiyoshida,
Yamanashi 403-0005, *Japan*
Tel.: 81-555-72-6194
Fax: 81-555-72-6206
E: koshi@yies.pref.yamanashi.jp

Kowallis, Bart Joseph
Dept. of Geology

Brigham Young Univ.
Provo, UT 84602, *USA*
Tel.: 1-801-378-2467
Fax: 1-801-378-2265

Krochmal, Michael
Autoscan Systems Pty. ltd.
PO Box 112
Ormond, VIC 3204 *Australia*
Tel.: + 61 39 596 8065 / 8092
Fax: + 61 39 596 8369
E: autoscan@autoscan.com.au

Lal, Nand
Dept. of Geophysics
Kurukshetra Univ.
Kurukshetra-132119, *India*

Laslett, Geoff
CSIRO Mathematical and
Information System
Priv. Bag 10, Clayton South MDC,
Clayton,VIC 3169, *Australia*
Tel.: +61 3 9545 8018
Fax.: +61 3 9545 8080
E: Geoff.Laslett@cmis.csiro.au

Lewis, Cherry L. E.
Robertson Research Int. Ltd.
Llanrhos, Llandudno, Gwynedd,
North Wales, LL30 1SA, *UK*

Linn, Jon
WVDEP/TAGIS
10 McJunkin Rd,
Nitro, WV 25143, *USA*
Tel.: (304) 759-0519
Fax: (304) 759-0565
E: jlinn@crimson.osmre.gov

Lisker, Frank
FB5 - Geowissenschaften
Universitaet Bremen
PF 330440 Bremen, *Germany*
E: flisker@geopol.uni-bremen.de

Lutz, Timothy M.
Dept of Geology and Astronomy
West Chester University
West Chester, PA 19383, *USA*

Mahon, Keith I.
Exxon Production Research
Company, MS: ST-2164
P.O. Box 2189
Houston, TX 77252-2189, *USA*
Tel.: +1 (713) 965-7036
Fax: +1 (713) 965-2779
E: keith.i.mahon@exxon.sprint.com

Maksaev, Victor
Dept. of Geology,
University of Chile
Casilla 13518, Correo 21,
Santiago,
Chile
Tel.: (562) 678 4112
Fax: (562) 696 3050
E:
vmaksaev@tamarugo.cec.uchile.cl

Märk, E.
Hohrere technische Bundeslehr-
und Versuchsanstalt Anichstr.
26-28
A 6020 Innsbruck, *Austria*

Märk, T. D.
Abt. f. Kernphysik u.
Gaselektronik
Institut f. Experimentalphysik
Leopold Franzens Universität
A 6020 Innsbruck, *Austria*

Marshallsea, Susan
Geotrack International Pty Ltd
37 Melville Road
West Brunswick
VIC 3055, *Australia*
Tel.: +61-3-9380-1077
Fax: +61-3-9380-1477
E: mail@geotrack.com.au

Matsuda, Takaaki
Himeji Institute of Technology
2167, Shosha Himeji
Hyogo 671-22, *Japan*

Maze, Will B.
Exxon Production Research
P.O. Box 2189
Houston, TX 77252-2189, *USA*
Tel.: 1-713-965-7223
Fax: 1-713-965-7951

McCorkell, Robert
CANMET, Mineral Technology
Energy, Mines and Resources
555 Booth Street
Ottawa, Ontario K1A 0G1,
Canada

McCulloh, Thane H.
7136 Aberdeen
Dallas, TX 75230, *USA*
Tel.: 1-214-691-6809

Meyer, Arnaud J.
ELF AQUITAINE-CSTJF L1/010
64018 Pau Cedex, *France*

Miller, Elizabeth L.
Dept. of Geology, Stanford Univ.
Stanford, CA 94305-2115, *USA*
Tel.: 1-415-723-1149
Fax: 1-415-725-2199
E: miller@pangea.stanford.edu

Mitchell, Melinda M.
Department of Earth Sciences
La Trobe University
Bundoora, VIC 3083, *Australia*
Tel.: 61-3-479-1274,
Fax: 61-3-479-1272
E: geomm@luff.latrobe.edu.au

Moore, Marilyn
Geotrack International Pty Ltd
37 Melville Road
West Brunswick
VIC 3055, *Australia*
Tel.: +61-3-9380-1077
Fax: +61-3-9380-1477
E: mail@geotrack.com.au

Mora, Jorge
Dept. of Geological Science
State Univ. of New York
Albany, NY 12222, *USA*

Mora, Jorge
Escuela de Geologia
Minas y Geofisica
Facultad de Ingenieria
Universidad Central de Venezuela
Caracas, *Venezuela*

Murphy, John M.
Dept. of Geology and Geophysics
Univ. of Wyoming
Laramie, WY 82071, *USA*
Tel.: 1-307-766-5435
E: geojm@uwyo.edu

Naeser, Chuck & Nancy
U.S. Geological Survey
926a National Center
Reston, VA 22092, *USA*
Tel.: 703 648-6964 (Chuck)
Tel.: 703 648-5328 (Nancy)
Fax: 703 648-6953 (both)
E: cnaeser@usgs.gov

Nishimura, Susumu
Dept. of Geology and Mineralogy
Kyoto Univ.
Kyoto 606, *Japan*
Tel.: 81-75-753-4150,
Fax: 81-75-753-4189

Noble, Wayne P.
Department of Earth Sciences
La Trobe University
Bundoora, VIC 3083, *Australia*
Tel.: 61-3-479-2630
Fax: 61-3-479-1272
E: geowpn@luff.latrobe.edu.au

Oddone, Massimo
Dipartimento di Chimica Generale
viale Taramelli, 12
27100 Pavia, *Italy*

Ohira, Hiroto
Dept. of Geoscience,
Shimane Univ.,
Matsue 690, *Japan*
Tel.: 81-852-32-6465
Fax: 81-852-32-6469
E: ohira@botan.shimane-u.ac.jp

Olesch, Martin
Univ. Bremen
FB 5 Geowissenschaften
Postfach 330 440
2800 Bremen, 00071-00 *Germany*
Tel.: +49-421-2183940
Fax: +49-421-2183993

Omar, Gomaa I.
Geology Dept.
Univ. of Pennsylvania
Philadelphia, PA 19104, *USA*

Ono, Masako
Hokkaido University
Kyoyo-chigaku
N17-W8, Kita-ku
Sapporo, 060, *Japan*
Tel.: 81-11-716-2111, ext. 5309
Fax: 81-11-736-3290
E: mo@epms.hokudai.ac.jp

O'Sullivan, Andrea J.
Department of Earth Sciences
La Trobe University
Bundoora, VIC 3083, *Australia*
Tel.: 61-3-479-3517
Fax: 61-3-479-1272
E: allanw@met.Unimelb.EDU.AU

O'Sullivan, Paul B.
Department of Earth Sciences
La Trobe University
Bundoora, VIC 3083, *Australia*
Tel.: 61-3-9479-3517
Fax: 61-3-9479-1272;
E: P.Osullivan@latrobe.edu.au

Pagel, Maurice
Universiti de Paris XI –
ORSAYTERRE Bbt. 504
90405 Orsay Cedex, *France*
Tel.: 33-1-69-15-67-55
Fax: 33-1-68-15-48-82

Pagliuca, Renato
Dept. of Geological Sciences
Pavia University
Via Ferrata, 1
27100 PAVIA, *Italy*
Tel.: +39-382-50-5839
Fax: +39-2-523-0197
E: ullayu@tin.it

Pan , Yun
Dept. of Geological Sciences
Univ. of SUNY at Albany
NY 12222, *USA*

Parand, Simon
Geological Survey of Iran,
P.O. Box 13185-1494 Tehran, *Iran*
Fax: 98216009328

Paul, Tracy A.
Dept. of Chemistry
Arizona State Univ.
Tempe,. AZ 85287-1404, *USA*
Tel.: 1-602-921-1306
E: agtxp@asuacad

Pengji, Zhai
Institute of High Energy Physics
Academia Sinica
P.O. Box 2732
Beijing 100080, *PR China*

Perelygin, V. P.
Flerov Laboratory of Nuclear
Reactions
Joint Institute for Nuclear
Research
Post Office Box 79
101 000 Moscow, *Russia*

Perez De Armas, Jaime G.

Dept. of Geology and Geophysics
Rice University., MS-126
Houston, TX 77025, *USA*
E: jaime@rice.edu

Petford, N.
Bullard Lab.
Dept. of Earth Sciences
Univ. of Cambridge
Madingly Rise
Cambridge, CB3 0DZ, *UK*

Poupeau, Gerard R.
Universite Joseph Fourier
Institut Dolomieu
15, Rue Maurice - Gignoux
38031 Grenoble Cedex, *France*
Tel.: (33)-(0)4-76-63-59-30 / 59-64
Fax: (33)-(0)4-76-87-82-43
E: Poupeau@ujf-grenoble.fr

Prashad, Rajinder
Fission Track Laboratory
KDM Institute of Petrol. Exploration
Oil and Natural Gas Corporation
Dehradun, *India*.

Price, P. Buford
Dept. of Physics
Univ. of California
Berkeley, CA 94720, *USA*
Tel.: 1-510-642-4982,
Fax: 1-510-643-8497
E: price@lbl.qov

Puch, Thomas
Insitute für Geologie and Paläontologie
Karl-Franzens Universität
Heinrichstraße 26
A-8010 Graz, *Austria*
Fax: 43-316-382885

Qvale, Henning
Institute for Energy Technology
P.O. Box 40
N 2007, Kjeller, *Norway*
Tel.: +47-63-80-61-22,
Fax: +47-63-81-55-53
E: hq@varney.ite.no

Rahn, Meinert
Institut fuer Mineralogie,
Petrologie und Geochemie
Univ. of Freiburg
Albertstrasse 23b
79104 Freiburg, *Germany*
Tel: 49-761-2036416
Fax: 49-761-2036407
E: meinert@mis01.mineralogie.uni-freiburg.de

Ratschbacher, Lothar
Institut fuer Geologie
Universitaet Wuerzburg,
Pleicherwall 1, D-97070
Wuerzburg, *Germany*
Tel.: +49-931-312580
Fax: +49-931-312378
E: lothar@geologie.uni-wuerzburg.de

Ravenhurst, Casey E.
Dept. of Geology and Geography
Univ. of Massachusetts
Amherst MA 01003, *USA*
E: cravenhu@geo.umass.edu

Raza, Asaf
Department of Earth Sciences
La Trobe University
Bundoora, VIC 3083, *Australia*
Tel.: 61-3-479-2630
Fax: 61-3-479-1272
E: geoar@luff.latrobe.edu.au

Rebetez, Michel
Universite de Franche-Comte
U.F.R. des Sciences et des Techniques
Laboratoire de Microanalyses Nucleaires
16, route de Gray
F-25030 Besancon Cedex, *France*

Redfield, Thomas F.
Technical Exploration Services
5 Frost Court
Mill Valley, CA 94941, *USA*

Roden-Tice, Mary, K.
Center for Earth & Environ. Science
SUNY Plattsburgh
Plattsburgh, NY 12901, *USA*
Tel.: 1-518-564-2019
Fax: 1-518-564-3152

Saenz, Carlos Alberto Tello
Instituto de Fisica "Gleb Wataghin"
Universidade Estadual de Campinas
UNICAMP, Campinas, SP, *Brazil*
Caixa Postal 6165
CEP 13083-970
Tel.: 55-19-788-5522
Fax: 55-19-788-5512
E: saenz@ifi.unicamp.br

Saini, Hari Singh
Dept. of Radiometric Dating
Birbal Sahni Institute of Paleobotany
53 Univ. Road
Post Box 106
Lucknow 226 007, *India*

Sandhu, Amanjit S.
Dept. of Physics
Guru Nanak Univ.
Amritsar 143005, *India*
E: cse@gndu.ernet.in

Schaefer, Thorsten
Universitaet Bremen Fachbereich Geowissenschaften PO Box 330 440 D-28334 Bremen, *Germany*
Tel.: 0049 421 218 3994
Fax: 0049 421 218 3993
E: postgrad@geopol.unibremen.de

Schierl, Heimo
Institut f. Geologie und Palaeontologie,
Universität Salzburg,
Hellbrunnerstraße 34/III,
A-5020 Salzburg, *Austria*
Tel.: + 43-662-8044-5437
Fax: + 43-662-8044-621

Schwab, Martina
Institut fuer Geologie
Universitaet Tuebingen
Sigwartstrasse 10, D-72076
Tuebingen, Germany
E: martina.schwab@uni-tuebingen.de

Sekyra, Gerd
Institut f. Geologie und Palaeontologie,
Universität Salzburg,
Hellbrunnerstraße 34/III,
A-5020 Salzburg, *Austria*
Tel.: + 43-662-8044-5437
Fax: + 43-662-8044-621

Seward, Diane
Geology Institute
ETH-Zentrum
Sonneggstrasse, 5
8092, Zurich, *Switzerland*
Tel.: 0041-1- 632-7702,
Fax: 0041-1- 632-1080
E: diane@eurasia.ethz.ch

Shane, Phil
School of Environ. & Marine Sci.
Univ. of Auckland
Tamaki Campus
Private Bag 92019
Auckland, *New Zealand*
Tel.: 64-9-373 7599 ext. 6821
Fax: 64-9-373 7042

Shunsheng, Liu
Changsha Institut of Geotectonics
Academia Sinica
Changsha 410013
Hunan Province, *PR China*
Tel.: 86-731-8859165
Fax: 86-731-8859137

Siddall, Ruth
Fission Track Research Group
Geological Sciences
Univ. College London
London WC1E-6BT, *UK*
Tel.: 0171-380-7777 ext. 2758
Fax: 0171-388-7614
E: r.siddall@ucl.ac.uk

Singh, Gurinder
Dept. of Physics
Guru Nank Dev Univ.
Amritsar 143005, *India*

Sobel, Ed
Institut fuer Geowissenschaften
Universität Potsdam
Postfach 60 15 53
D-14415 Potsdam, *Germany*
Tel: (49) (0331) 977-2904 or -2047
Fax: (49) (0331) 977-2087
E: sobel@rz.uni-potsdam.de

Sohrabi, Mehdi
Radiation Protection Dept.
Atomic Energy Organization of Iran
P.O. Box 14155-4494
Tehran, *Iran*

Sorkhabi, Rasoul B.
Dept. of Geology
Arizona State Univ.
Tempe, AZ 85287-1404, *USA*
Tel.: 1-602-965-9852/5081
Fax: 1-602-965-8102
E: idrbs@asuvm.inre.asu.edu

Spikings, Richard
Geology Institute
ETH-Zentrum
Sonneggstrasse, 5
8092, Zurich, *Switzerland*
Tel.: 0041-1- 632-7702,
Fax: 0041-1- 632-1080
E: georas@luff.latrobe.edu.au

Stapel, Gerco
Inst. voor Aardwerenschappen
Vrije Universiteit
De Boelenlaan 1085
1081 HV Amsterdam, *The Netherlands*
E: stag@geo.vu.nl

Steckler, Michael S.
Lamont-Doherty Earth Observatory
Palisades, NY 10964, *USA*
Tel.: 1-914-365-8479,
Fax: 1-914-365-8179
E: steckler@ldeo.columbia.edu

Steinmann, Michael
Dept. Erdwissenschaften
ETH-Zentrum
CH-8092, Zurich, *Switzerland*

Stiberg, Jan-Petter
Institute for Energy Technology
P.O. Box 40, N 2007
Kjeller, *Norway*
Tel.: +47-63-80-61-22,
Fax: +47-63-81-55-53

Stockli, Danny
Dept. Geological Sciences
Stanford Univ.
Stanford, CA 94305-2115, *USA*
Tel.: (415) 723 1010
E: danny@pangea.stanford.edu

Stockmal, Glen S.
Geological Survey of Canada
Institute of Sedimentography and

Petroleum Geology
3303-33rd Street, N.W.
Calgary, Alberta T2L 2A7, *Canada*
Tel.: 1-403-292-7173
Fax: 1-403-292-5377
E: GStockma@NRCan.gc.ca

Storzer, Dieter
Museum d'histoire naturelle
Laboratoire de Mineralogie
61 rue Buffon,
75005 Paris, *France*

Stump, Edmund
Dept. of Geology
Arizona State Univ.
Tempe, AZ 85287-1404, *USA*
Tel.: 1-602-965-3971/5081
Fax: 1-602-965-8102
E: ateds@asuacad.

Sumii, Tomoaki
Isotope Geoscience Section
Geochemistry Dept.
Geological Survey of Japan
1-1-3 Higashi, Tsukuba, 305, *Japan*
Tel.: 81-298-54-3558,
Fax: 81-298-54-3533
E: sumii@gsj.go.jp

Summerfield, Michael
Dept. of Geography
School of Earth Sciences
Univ. of Edinburgh
Edinburgh EH8 9XP, *UK*
Tel.: +44-31-650-2519

Sun, Shaohua
Changsha Institut of Geotectonics
Academia Sinica
Changsha 410013
Hunan Province, *PR China*
Tel.: 86-731-8887945 (home)
Fax: 86-731-8859137
E: shaohua@ms.csig.ac.cn

Suzuki, Masao
Rikkyo Univ.
34-1 Nishi Ikebukuro
3-Chome, Toshima-ku
Tokyo 171, *Japan*

Tagami, Takahiro
Dept. of Geology and Mineralogy
Kyoto Univ.
Kyoto 606, *Japan*
Tel.: 81-75-753-4153
Fax: 81-75-753-4189
E: tagami@terra.kueps.kyoto-u.ac.jp

Talbot, James
K/T GeoServices, Inc.
661 North Plano Rd, Suite 317
Richardson, TX 75081, *USA*
Tel.: (972) 437-9337
Fax: (972) 437-0455
E: jptkt@flash.net

Thomson, Stuart
Institut für Geologie
Ruhr-Universität Bochum
Universitätsstraße 150
P.O. Box 102148
Bochum 44721, *Germany*

Toro, Gloria
Universidad EAFIT
A.A. 3300
Medellin, *Colombia*
E: gtoro@sigma.eafit.edu.co

Upton, David
Fission Track Research Group
Dept. of Geological Sciences
Univ. College London
London WC1E 6BT, *UK*
Tel.: (0)171-380-7777 ext 2418
Fax: (0)171-813-2802

Vance, Joseph, A.
Dept. of Geological Sciences
Univ. of Washington
Seattle, WA 98195, *USA*

Van den haute, Peter
Geologisch Instituut
Rijiks Universiteit
B-9000 Gent, *Belgium*
Tel: +32-0-9-264/4592 or 6627
Fax: +32-0-9-264-4984
E: Peter.Vandenhaute@rug.ac.be

Van der Wateren, F. M.
Institue for Earth Science
Vrije Universiteit
De Boelelaan 1085, 1081 HV
Amsterdam, *The Netherlands*

Ventura, Barbara
Dipartimento di Scienze Geologiche
Universita di Bologna
via Zamboni 67
40127 Bologna, *Italy*
Tel: +39-51-354579
Fax: +39-51-354522
E: ventura@geomin.unibo.it

Vercoutere, Caroline
Geologisch Instituut
Rijiks Universiteit
B-9000 Gent, *Belgium*

Viola, Giulio
Geologisches Institut
Sonneggstrasse 5
ETH-Zentrum
CH-8092, Zurich, *Switzerland*
Tel.: 0041-1-252-2227
Fax: 0041-1-252-7008
E: giulio@erdw.ethz.ch

Virk, H. S.
Dept. of Physics
Guru Nanak Dev Univ.
Amritsar-143005, *India*

Wadatsumi, Kiyoshi
Dept. of Geosciences
Osaka City Univ.
3-3-138 Sugimoto
Sumiyoshi-ku
Osaka 558, *Japan*

Wagner, Gunther A.
Max-Planck-Institut fur Kernphysik
Saupfercheckweg, D-6900
Heidelberg, *Germany*

Wagner, Martin
Institut fur Petrographie und Geochimie
Universität Karlsruhe
Kaiserstr. 12
D-7500 Karlsruhe, *Germany*

Wallace, Wes K.
Dept. of Geology and Geophysics
University of Alaska
Fairbanks, AK 99775-5780 , *USA*
Tel.: (907) 474-5386
Fax: (907) 474-5163
E: wallace@gi.alaska.edu

Walgenwitz, Frederic
ELF AQUITAINE-CSTJF L1/010
64018 Pau Cedex, *France*

Walker, J. D.
Dept. of Geology
Univ. of Kansas
120 Lindley Hall
Lawrence, KS 66045-2969, *USA*

Walker, Robert M.
McDonnell Center for Space Sciences
Campus Mail 1105
Washington Univ.
St. Louis, MO 63130, *USA*
Tel.: 1-314-935-6225
Fax: 1-314-935-6219
E: brw@wuphys.wustl.edu

Walter, Bob
Institute of Human Origins
1288 Ninth Street
Berkely, CA 94709-1211, *USA*
Tel.: 1-510-525-0500,
Fax: 1-510-525-0668
E: bwalter@iho.org

Waraich, R. S.
Fission Track Laboratory
KDM Institute of Petrol. Exploration
Oil and Natural Gas Corporation
Dehradun, *India.*

Watanabe, Koichiro
Dept. of Mining
Faculty of Engineering
Kyushu Univ.,
36 Hakozaki, Fukuoka 812, *Japan*
Tel.: 81-92-642-3634
E: wat@mine.kyushu-u.ac.jp

Weiland, Richard J.
Dept. of Geological Sciences
Univ. of Texas at Austin
Austin, TX 78712, *USA*
Tel.: 1-512-471-8547,
Fax: 1-512-471-9425
E:weiland@maestro.geo.utexas.edu

Westgate, John A.
Dept. of Geology
Univ. of Toronto
Scarborough, Ontario
M1C 1A4, *Canada*
E: westgate@banks.scar.utoronto.ca

Willet, Sean D.
Dept of Geosciences
Pennsylvania State University
University Park, PA 16802, *USA*
Tel.: 1-814-865-3951
Fax: 1-814-863-7823
E: sean@geosc.psu.edu

Winkler, Jennifer
ARCO Exploration & Production
2300 W. Plano Parkway
Plano, TX 75075-8499, *USA*
E: jwinkle@mail.arco.com

Yamashita, Tohru
Kyoto Fission-Track Co., Ltd.
44-4 Minamitajiri-cho, Kita-ku,
Kyoto 603, *Japan*
Tel.: +81-75-493-0684
Fax.: +81-75-493-0741
E: BYU02730@niftyserve.or.jp

Yang, Tsanyao Frank
Dept. of Geology, National Taiwan University, 245 Chou-shan Road, Taipei 106-17, *Taiwan*
Tel: (+886) 2-2369-5568
Fax: (+886) 2-2363-6095
E: tyyang@ccms.ntu.edu.tw

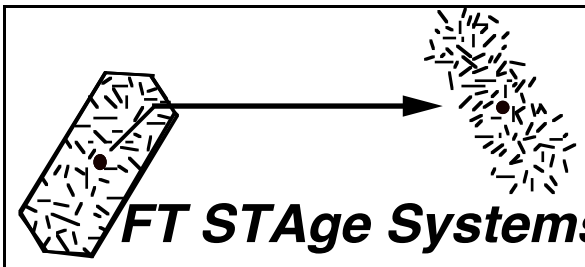
Yegingil, Zehra
Physics Dept.
Cukurova Univ.
P.O. Box 171
01330 Adana, *Turkey*

Yoshioka, Tetsu
Kyoto Fission-Track Co., Ltd.
44-4 Minamitajiri-cho, Kita-ku
Kyoto 603, *Japan*
Tel.: +81-75-493-0684
Fax: +81-75-493-0741
E: BYU02730@niftyserve.or.jp

Zattin, Massimiliano
Dipartimento di Scienze Geologiche
Universita di Bologna
via Zamboni 67
40127 Bologna, *Italy*
Tel: +39-51-354579
Fax: +39-51-354522
E: zattin@geomin.unibo.it

Zhao, Yunlong
Beijing Research Institute of Uranium Geology
P.O. Box 764
Beijing 100029, *PR China*

Zeitler, Peter K.
Dept. of Earth & Environ. Sciences
Lehigh Univ.
Bethlehem, PA 18015, *USA*
Tel.: 1-215-758-3671
Fax: 1-215-758-3677
E: pkz0@lehigh.edu
Zentilli, Marcos,
Dept. of Earth Sciences
Dalhousie Univ.
Halifax, Nova Scotia, B3H 3J5,
Canada
Tel.: 1-902-494-3873
Fax: 1-902-494-6889
E: zentilli@ac.dal.ca
Zhou, Zuyi
Dept. of Marine Geology and
Geophysics,
Tongji University
1239 Siping Road 200092
Shanghai, *China*
Tel.: 0086-21-65982358
Fax: 0086-21-65026278
E: zzydmg@tju.ihep.ac.cn
Zimmerman, Robert Allen
U.S. Geological Survey, MS 905
Box 25046, Federal Center
Denver, CO 80225, *USA*
Tel.: 1-303-236-5626,
Fax: 1-303-236-5603
E:
rzimm@greenwood.ct.usgs.gov.intern
et
Zuffa, Gian G.
Dipartimento di Scienze
Geologiche
Universita di Bologna
via Zamboni 67
40127 Bologna, *Italy*
Tel.: 39-51-354536
Fax: +39-51-354522
E: zuffa@geomin.unibo.it



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Fission Track Laboratories Using the System:

- Stanford University, Stanford, California, installed in 1991
- University of California, Santa Barbara, California, installed in 1992
- ARCO Exploration and Production Technology, Plano, Texas, installed in 1992
- Universität Bremen, Bremen, Germany, installed in 1993
- E.T.H., Zürich, Switzerland, installed in 1993 using a preexisting stage
- Kent State University, Kent, Ohio, installed in 1993
- University of Wyoming, Laramie, Wyoming, installed in 1993
- University of Arizona, Tucson, Arizona, installed in 1993
- Max-Planck-Institut, Heidelberg, Germany, installed in 1993 using a preexisting stage
- Union College, Schenectady, New York, installed in 1994
- Monash University, Melbourne, Australia, installed in 1994 using a new Zeiss stage
- La Trobe University, Melbourne, Australia, installed in 1994 using two new Zeiss stages
- University of Pennsylvania, Philadelphia, Pennsylvania, installed in 1995
- Universität Tübingen, Tübingen, Germany, installed in 1995
- Universidad Central de Venezuela, Caracas, Venezuela, installed in 1995
- Brigham Young University, Provo, Utah, installed in 1995
- Central Research Institute of the Electric Power Industry, Chiba, Japan, installed in 1995
- Universität Salzburg, Salzburg, Austria, installed in 1996
- University of Southern California, Los Angeles, California, installed in 1996
- E.T.H., Zürich, Switzerland, second system installed in 1996 using a preexisting stage
- Geologisk Centralinstitut, Copenhagen, Denmark, installed in 1996 using a preexisting stage
- University of Waikato, Hamilton, New Zealand, installed in 1996 using a preexisting stage
- Università di Bologna, Bologna, Italy, installed in 1997
- Centro di Studio di Geologia dell'Appenno e delle Catene Perimediterranee, Florence, Italy, installed in 1997
- University of Wyoming, Laramie, Wyoming, second system installed in 1997
- Universität Potsdam, Potsdam, Germany, installed in 1997
- Seoul National University, Seoul, Korea, installed in 1998
- E.T.H., Zürich, Switzerland, third system installed in 1998
- Universität Basel, Basel, Switzerland, installed in 1998
- University of Florida, Gainesville, Florida, installed in 1998
- Universite Paris-XI, Paris, France, installed in 1998

Further Information:

An early version of the system is described in a paper in Nuclear Tracks and Radiation Measurements, vol. 21, p. 575-580, Oct. 1993. For detailed information please contact: Dr. Trevor Dumitru, 4100 Campana Drive, Palo Alto, California 94306, U.S.A., telephone (auto-switching voice and fax line): 1-650-725-6155

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TECTONIC PROCESSES

Departments of Oceanography and Earth Sciences,
Dalhousie University
and
The Canadian Institute for Advanced Research

Applications are invited for a tenure track assistant professor position in Tectonic Processes. The successful candidate will be appointed in both departments and will strengthen tectonics at Dalhousie by teaching undergraduate and graduate courses, supervising M.Sc. and Ph.D. students, and by developing and maintaining a vigorous externally funded research programme.

S/he will also be appointed a "Scholar" in the Earth System Evolution Programme (ESEP) of the Canadian Institute for Advanced Research (CIAR). Candidates should have an interest in quantitative interdisciplinary research in relationships between tectonic processes and Earth evolution. The successful candidate will have a record of achievement and assessed potential necessary to be appointed by CIAR. As a member of ESEP, the incumbent will be partly supported by CIAR and during this time will benefit from reduced teaching responsibilities and from association with an international network of researchers in earth system sciences.

A Ph.D. is required by date of appointment and post-doctoral experience is desirable. Applications should include a c.v., statement of research/teaching objectives, names, addresses, phone and emails of four referees; and be sent to:

Chair, Tectonics Search Committee
Department of Earth Sciences
Dalhousie University
Halifax, NS Canada, B3H 3J5

Phone: (902) 494-2358 FAX: (902) 494-6889
Email: earth.sciences@dal.ca

For more information access our websites:
http://www.phys.ocean.dal.ca;
http://meguma.earthsciences.dal.ca/es-home.htm;
www.ciar.ca

Applications will be considered as soon as they are complete, but will be accepted until March 31, 1999.

Dalhousie University is an employee Equity / Affirmative Action Employer. The University encourages applications from qualified women, Aboriginal peoples, racially visible people and persons with disability. In accordance with Canadian Immigration requirements, priority will be given to Canadian citizens and permanent residents.

CIAR Scholar and Assistant Professor in Tectonic Processes

The Canadian Institute for Advanced Research and Dalhousie University are committed to strengthen research at Dalhousie and in the Earth System Evolution program of CIAR through the appointment of a CIAR 'Scholar' (tenure track Assistant Professor) in Tectonic Processes. The appointment will be made jointly by the Oceanography and Earth Sciences Departments and be equally funded by CIAR and Dalhousie for the first five years, after which time Dalhousie will fully fund the position.

We are seeking a young earth scientist with proven abilities and outstanding potential. We anticipate that the successful applicant will complement Dalhousie's and ESEP's existing strengths and broaden our capabilities in the following manner.

EarthSciences and Oceanography at Dalhousie have established strengths in Oceanographic research (Physical, Biological, Chemical and Geological subdisciplines) and in Marine Geology and Geophysics, Geochronology (Argon-Argon, Fission Track and Luminescence laboratories), and Tectonics. In particular, Tectonics research encompasses aspects of structural, metamorphic and igneous geology, geodynamics, seismic crustal studies, geochronology, sedimentology and economic geology. We seek a person with expertise to complement and integrate across our existing tectonic strengths.

CIAR continues to support the Geodynamics Group at Dalhousie, which focuses on tectonic processes through the development and application of geodynamical computer models. These models include mantle-lithosphere interactions; crustal deformation and thermal evolution; the Earth's response to surface processes; and the formation of sedimentary basins and sedimentation within these basins. We seek a person with quantitative abilities who will contribute to the development and/or application of geodynamical models, will develop a complementary innovative research program, and will apply the results of this research to primary problems in tectonics.

The CIAR Earth System Evolution Program seeks an improved understanding of earth system interactions responsible for the development of the solid earth, hydrosphere, atmosphere and biosphere. Tectonic processes, mantle dynamics and their consequences for the Earth's surface are held to be key components in the Earth System. The CIAR-ESEP network brings together an internationally respected group of scientists. The existing focal points in geochemistry and geodynamics will be broadened to include among other fields, paleoclimatology, paleogeography, paleobiology, tectonics and surficial processes. The Dalhousie 'Scholar' will strengthen the tectonics component of the program directly and the ESEP program as a whole by developing research that leads to improved understanding of the impact of tectonics on other components of the Earth System.